Clinical Research

ENT Updates 2018;8(1):19–26
doi:10.2399/jmu.2018001001

ENT updates
www.entupdates.org

An evaluation of peripheral arterial tonometry for the diagnosis of obstructive sleep apnea

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Abstract

Objective: Peripheral arterial tonometry (PAT) as a portable method of monitoring sleep quality is a relatively recent innovation. The aim was to compare the results of PAT and polysomnography (PSG) and to evaluate the role of PAT in diagnosing obstructive sleep apnea syndrome (OSAS).

Methods: This study included adult patients who admitted to ENT clinic with OSAS complaints (excessive daytime sleepiness, snoring, and witnessed apnea), undergone sleep monitorization using PAT system (WatchPAT 200™; Itamar Medical Ltd., Caesarea, Israel) and had single-blind, level 1 polysomnography at sleep laboratory of Chest Diseases Department.

Results: For the two sleep monitoring sessions as conducted at different times: the apnea-hypopnea index (AHI) and respiratory disturbance index (RDI) values were strongly correlated between sessions (r=0.749, r=0.753; p<0.001). The oxygen desaturation index (ODI) values were very strongly correlated (r=0.861; p<0.001). When the AHI scores calculated using PAT for the patients enrolled in the trial were taken into consideration; 89.7% of the patients were correctly diagnosed with OSAS (AHI≥5); for RDI calculated (RDI≥5) using PAT, 100% of OSAS diagnoses were correct; for AHI values calculated with the PAT method, taking 15 as cut-off point, the sensitivity was found to be at an extremely high level of 96.1%.

Conclusion: PAT and PSG values were highly correlated. This finding demonstrated that the reproducibility of the results obtained with PAT was also high. This study shows that PAT can be used as a screening test for OSAS and in a group of patients who are highly suspected for OSAS.

Keywords: Obstructive sleep apnea, peripheral artery tonometry, polysomnography, apnea-hypopnea index, oxygen desaturation index.

Özet: Obstrüktif uyku apnesi tanısında periferik arteriyel tonometrinin değerlendirilmesi

Amaç: Periferik arteriyel tonometrinin (PAT), uyku monitörizasyonunda taşınabilir bir yöntem olarak kullanımı kısmen yeni bir yöntemdir. Bu çalışmada, PAT sonuçları ile polisomnografi (PSG) sonuçlarının karşılaştırılması ve obstrüktif uyku apnesi sendromu tanısında PAT'ın rolününün değerlendirilmesi amaçlandı.

Yöntem: Bu çalışmaya KBB kliniğine OSAS şikayetleri (gündüz uykululuk hali, horlama ve tanıklı apne) ile başvurmuş ve uyku monitörizasyonu PAT sistemi (WatchPAT 200™; Itamar Medical Ltd., Caesarea, İsrail) ile yapılmış, daha sonra Göğüs Hastalıkları Uyku Laboratuvarında kör olarak level 1 polisomnografi uygulanmış erişkin hastalar dahil edildi.

Bulgular: İki farklı zamanda yapılmış uyku monitörizasyonunda apne hipopne indeksi (AHI) ve solunum bozukluğu indeksi (RDI) değerleri yüksek oranda korele idi (r=0.749, r=0.753; p<0.001). Oksijen desatürasyon indeksi (ODI) değeri ise çok yüksek oranda korele saptandı (r=0.861; p<0.001). Çalışmaya dahil edilen hastaların AHI skorları PAT yöntemiyle ölçüldüğünde; hastaların %89.7'si OSAS için (AHI≥5) doğru tanı aldı; PAT testinde, RDI'ye göre yapılan değerlendirmede (RDI≥5) OSAS tanılarının %100'ü doğru idi; PAT yöntemiyle yapılan ölçümde AHI değeri için eşik değeri 15 olarak kabul edildiğinde, duyarlılık %96.1 olarak oldukça yüksek bulundu.

Sonuç: PAT ve PSG değerleri yüksek oranda korele idi. Bu durum PAT ile elde edilen sonuçların tekrarlanabilirliğinin de yüksek olduğunu göstermiştir. Çalışmamız PAT'ın OSAS'da tarama testi olarak ve yüksek oranda OSAS şüphesi olan hasta grubunda kullanılabileceğini göstermektedir.

Anahtar sözcükler: Obstrüktif uyku apnesi, periferik arteriyel tonimetri, polisomnografi, apne hipopne indeksi, desatürasyon indeksi.

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Received: March 8, 2018; **Accepted:** March 24, 2018

This paper was presented as oral presentation at 5th Sleep Disorders Congress (5. Uyku Bozuklukları Kongresi), May 2016, Trabzon, Turkey.

Online available at:
www.entupdates.org
doi:10.2399/jmu.2018001001
QR code:

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Obstructive sleep apnoea (OSA) is a disorder of moderate prevalence in which there are alternating intervals of obstructive apnoea and hypopnoea. Sleeps becomes fragmented as a result of the patient's upper airway being closed repeatedly as he or she sleeps. OSA is the most frequently encountered of the sleep disorders within the International Classification of Sleep Disorders (ICSD) scheme, with a prevalence of between 3 and 17% of male adults, and 2 to 9% of females.[1–4]

Uncontrolled OSA produces a large number of health-related issues, such as excessive diurnal tiredness, reduced ability to think, mood disturbance, reduced well-being, metabolic disturbance, greater risk of circulatory disease and extreme diurnal drowsiness, which may lead to road traffic accidents or occupational injury.[5] OSA, combining with disproportionate diurnal drowsiness for which no other cause can be found, is labeled obstructive sleep apnea syndrome (OSAS).[6] Despite the level of seriousness of these complications, and whilst it is agreed that to establish the diagnosis of OSA at the gold standard level requires both a sleep laboratory and technical staff in attendance to perform a level 1 polysomnogram, in reality many patients are not diagnosed until late as a result of inadequate sleep laboratory facilities as well as long waiting times. There is a need for a technique that is diagnostic for OSA which is inexpensive, easily accessible, easy to use and measures accurately.

Peripheral arterial tonometry (PAT) is classified as a portable sleep monitoring device. In the PAT system, there is a fingertip sensor that continuously measures arterial volume changes by subtracting peripheral venous oscillations. Arterial volume changes are regulated by α-adrenergic innervation and reflect sympathetic activity. The resulting apnea, hypopnea episodes and arousals cause the sympathetic nervous system to be activated and thus peripheral vasoconstriction occurs and peripheral arterial volume reduces. These also cause the PAT signal to weaken and apnea is detected.[7]

In this study, we compared the results of PAT and polysomnography (PSG) and evaluated the role of PAT in diagnosing OSAS. In this study, the relationship between non-simultaneous level 1 polysomnography and PAT-based sleep monitoring was investigated in adult OSAS patients.

Materials and Methods

This study was undertaken at the ENT Department of the Faculty of Medicine at Recep Tayyip Erdoğan University, Rize, Turkey. Ethical Committee approval (No: 49/2016) was obtained from the University's Research Ethics Committee.

Subjects

For this study, adult patients who presented to the ENT clinic with symptoms of OSAS (daytime sleepiness, snoring and apnea witnessed by another person) were included. In the initial stage, sleep monitoring using a peripheral arterial tonometric system (WatchPAT 200™; Itamar Medical Ltd., Caesarea, Israel) was performed, then a blinded Level 1 polysomnogram was recorded in the sleep laboratory of Chest Diseases Department.

Exclusion criteria were as follows: moderate or severe degree of chest, neuromuscular or peripheral vascular disease, congestive heart failure, non-sinus cardiac arrhythmia, implantation of a permanent pacemaker, having undergone bilateral cervical or thoracic sympathectomy, a finger deformity which precludes fitting of the PAT probe, dependence on hypnotic or narcotic substances, having taken an alpha blocker within the past 24 hours, more than one month interval between the two sleep monitoring sessions or a change in body mass index (BMI) between administration of the two tests.

Peripheral arterial tonometry

Tonometry was undertaken using the WatchPAT 200™ device on patients who were suspected to be suffering from OSAS. They had symptoms such as snoring, disproportionate daytime drowsiness and episodes of apnea during sleep which had been observed by their spouses. WatchPAT can be worn when moving around, does not need to be under the control of a technician whilst in use, and records four channels, in particular, PAT signal, cardiac rate and oxygenation ratio for hemoglobin. An actigraphy allowed to estimate the length of time the patient spent asleep whilst the stages of sleep could be correlated with the spectral components of the PAT and the actigraphy measurements.

Device placement was on the patient's non-dominant side, around the wrist, with the PAT probe positioned on the same side, on the index finger, together with an oximeter, also on the same side, but on the ring finger. The device records the test, using special proprietary software (zzzPat™) which employs an algorithm capable of extracting 14 features from 2 stretches of time in which PAT amplitude and Interpulse periods (IPP) have been recorded.

Polysomnography

The patients entered in the trial all had Polysomnography performed in the sleep laboratory using the Comet computerised device (Grass-Telefactor, Astro-Med, West Warwick, RI, USA), set up to record 24 channels as fol-

lows: 8 channels for electroencephalography, 2 channels for electro-oculography, 2 channels for submental plus 4 channels leg electromyography, ECG, nasal and oral airflow (using a thermistor), thoracic and abdominal respiratory movement sensors, pulse oximetry (detecting SpO_2), microphone to detect snoring and a sensor detecting what position the patient is in.

Procedures for scoring test

The polysomnogram was interpreted following the 2012 Guidelines of the American Academy of Sleep Medicine (AASM). To meet the definition of apnea, airflow had to be decreased by at least 90% compared to just before the episode occurred, in a stretch of sleep lasting at least ten seconds. Hypopnea needed to satisfy the following criteria: (1) The amplitude of the highest signal strength had to be 30% less than before the episode, (2) Such decrease had to last at least ten seconds, and (3) either there was 3% lower oxygen saturation or the patient was aroused during the episode.

Apnea-hypopnea index (AHI) consisted of the total episodes of apnea and hypopnea over a period made up of sleep lasting in total for one hour (sleep-hour). Respiratory disturbance index (RDI) consisted of episodes of apnea, hypopnea and respiratory event related arousals (RERAs) per sleep-hour and oxygen desaturation index (ODI) was defined as total events featuring at least 3% reduction in oxygenation per sleep-hour.

The AASM Guidelines describes the stages of OSA as follows: RDI between 5 and 15 is "mild", above 15 and up to 30 is "moderate", whilst an RDI greater than 30 indicates a "severe" level of OSA.[8]

Interpretation of the test results was carried with blinding method for the WatchPAT results' conditions by a physician and sleep technician, both of whom had experience in sleep medicine.

In the report provided by our hospital, since arousals linked to respiratory events were included with the episodes of hypopnea, the reported AHI and RDI values were same; however, in the scores calculated by the PAT device and its dedicated software, the RDI and AHI results were indicated separately.

Statistical analysis

For this study, the following statistics were generated from the WP and PSG results: AHI, RDI, ODI, time spent in N3 stage sleep as a percentage of total time asleep (N3%), time spent in REM stage sleep as a percentage of total time asleep (REM%), mean oxygen saturation (MEAN $Sp0_2$), minimum oxygen saturation (MIN SpO_2) and the apnea-hypopnea index with the patient in a supine position (SUPINE AHI).

For the analysis of the data, the IBM SPSS Statistics 20 software (SPSS Inc., Chicago, IL, USA) was employed, using the following statistical tests: Spearman's rho test, Bland-Altman plot test, paired-samples t-test and McNemar's test. A p value of less than 0.05 was accepted significant in Spearman's rho test. Correlations were accepted significant at 0.05 level and above in paired-samples t-test and Mc Nemar's test.

Results

In total, 41 patients were enrolled in the study. Two patients were later excluded from the study. One patient's recording device developed a battery problem whilst the sleep data were being gathered, the other patient's data were partially lost whilst attempting to upload the device data onto the computer.

Of the 39 patients whose results were taken into account in the analysis, 31 were male (79.5%), 8 were female (20.5%). Their average age was 45.7±11.6 (range: 26 to 73) years, and BMI was 32.6±4.7 (range: 26 to 45).

The cases were categorized according to polysomnography as: normal (1 case, 2.5%), mild (11 cases, 28.2%), moderate (2 cases, 5.1%) and severe (25 cases, 64.1%). Mean AHI calculated from PSG results was 33.09±20.64 (range: 4.70 to 75), and was 32.88±21.96 (range: 1.30 to 81.10) according to WatchPAT results. **Table 1** shows the comparison of the mean values of the sleep variables between PSG and WatchPAT.

When the results of the two sleep-monitoring sessions were compared, AHI, RDI and ODI were found to be highly correlated between sessions (r=0.749, r=0.753, r=0.861; p<0.001). See **Table 2** and **Figs. 1–3**.

There was no significant difference (p>0.05) between the two sleep-monitoring sessions in terms of AHI, RDI, and ODI values (**Table 3**).

There was no significant difference between the mean values obtained for supine AHI (p>0.05) and moderate correlation was found (r=0.568).

Mean SpO_2 values were highly correlated (r=0.779) between WP and PSG, and no significant difference was found between their mean values (p>0.05). Although Min SpO_2 values were highly correlated on paired samples test-

Table 1. Measurements obtained by PAT and polysomnography*.

		PAT		PSG	
	N	Mean±SD	Min-max	Mean±SD	Min-max
AHI	39	32.88±21.6	1.30–81.10	33.09±20.4	4.70–75
RDI	39	35.73±20.8	4.90–81.30	33.09±20.4	4.70–75
Mean SpO_2	39	92.69±2.94	83.00–97.00	92.23±2.77	84.20–96.30
Min SpO_2	39	79.90±8.97	57.00–93.00	75.90±10.0	50.00–90.00
ODI	39	25.09±21.7	0.30–72.90	25.51±22.3	0.70–78.60
N3%	39	15.51±7.52	2.3–30.75	11.04±7.52	1.7–25.8
REM%	39	20.52±8.49	3.32–38.32	13.84±7.23	3.10–25.70
Supine AHI	39	42.98±27.4	2.1–101.3	44.74±26.6	2.9–87.50
Pulse MIN	39	66.21±10.9	66.9±10.2	66.62±10.1	41.00–88.00

*The data presented are for the total period of sleep. **Mean SpO_2:** mean oxygen saturation, **Min SpO_2:** minimum oxygen saturation; **N3%:** time spent in N3 stage sleep as a percentage of total time asleep; **ODI:** oxygen desaturation index; **Pulse MIN:** minimum pulse rate; **REM%:** time spent in REM stage sleep as a percentage of total time asleep; **Supine AHI:** apnea-hypopnea index with the patient in a supine position.

ing, there was a statistically significant difference between their mean values ($p<0.05$) (**Tables 2** and **3**).

The values for time spent in N3 stage sleep as a percentage of total time asleep (N3%) and time spent in REM stage sleep as a percentage of total time asleep (REM%) were significantly different ($p<0.05$).

Agreement in outcome between these two methods is illustrated by Bland-Altman plot in **Figs. 4** and **5**. In a single case, the only (2.5% of total observations) difference was between AHI and RDI beyond the acceptable deviation (1.96 standard deviation from the mean).

Table 2. Spearman's rho test results.

	r	p-value
BMI *vs* AHI 1	0.252	0.121
BMI *vs* AHI 2	0.262	0.107
AHI 1 *vs* AHI 2	0.749*	0.000
RDI 1 *vs* RDI 2	0.753*	0.000
ODI 1 *vs* ODI 2	0.861*	0.000
Min SpO_2 1 vs Min SpO_2 2	0.783*	0.000
Mean SpO_2 1 vs Mean SpO_2 2	0.779*	0.000
N3% 1 *vs* N3% 2	0.457	0.003
REM% 1 *vs* REM% 2	0.054	0.746
Supine AHI 1 *vs* Supine AHI 2	0.568*	0.000
Pulse Min 1 *vs* Pulse Min 2	0.745*	0.000

*Correlation is significant at the level where r equals to 0.05 and above. **1:** the data derived from sleep apnea testing with PAT; **2:** the data derived from PSG; **BDI:** body mass index; **Mean SpO_2:** mean oxygen saturation; **Min SpO_2:** minimum oxygen saturation; **N3%:** time spent in N3 stage sleep as a percentage of total time asleep; **ODI:** oxygen desaturation index; **Pulse Min:** minimum pulse rate; REM **%:** time spent in REM stage sleep as a percentage of total time asleep; **Supine AHI:** apnea-hypopnea index with the patient in a supine position; **vs:** versus.

Table 3. Paired samples t-test results.

	n	Mean	SD	p-value
AHI 1	39	32.88	21.965	0.922*
AHI 2	39	33.09	20.641	
RDI 1	39	35.73	20.689	0.223*
RDI 2	39	33.09	20.641	
Mean SpO_2 1	39	92.69	2.948	0.066*
Mean SpO_2 2	39	92.23	2.773	
Min SpO_2 1	39	79.90	8.979	0.000
Min SpO_2 2	39	75.90	10.303	
ODI 1	39	25.09	21.272	0.838*
ODI 2	39	25.51	22.633	
N3% 1	39	15.51	7.528	0.001
N3% 2	39	11.04	7.237	
REM% 1	39	20.52	8.498	0.000
REM% 2	39	13.84	5.232	
Supine AHI 1	39	42.98	27.046	0.641*
Supine AHI 2	39	44.74	26.468	
Pulse Min 1	39	66.21	10.494	0.698*
Pulse Min 2	39	66.62	10.210	

*Correlation is significant at the level where p equals to 0.05 and above. **1:** the data derived from sleep apnea testing with PAT; **2:** the data derived from PSG; **Mean SpO_2:** mean oxygen saturation; **Min SpO_2:** minimum oxygen saturation; **N3%:** time spent in N3 stage sleep as a percentage of total time asleep; **ODI:** oxygen desaturation index; **Pulse Min:** minimum pulse rate; **REM %:** time spent in REM stage sleep as a percentage of total time asleep; **SD:** standard deviation; **Supine AHI:** apnea-hypopnea index with the patient in a supine position.

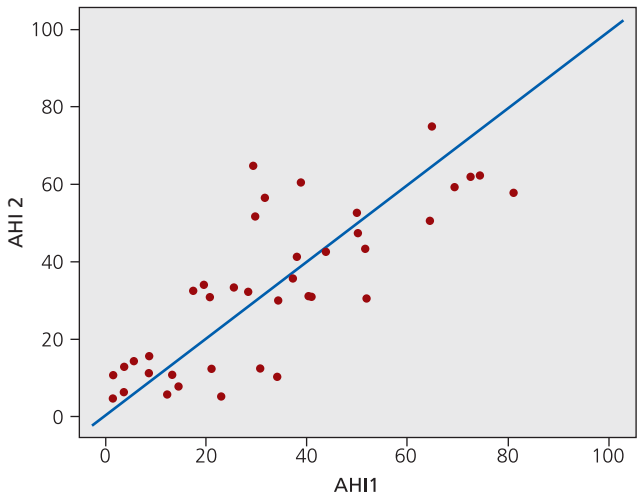

Fig. 1. Scatter plot of AHI 1 versus AHI 2. There was a high correlation between AHI 1 versus AHI 2 (r=0.749, p<0.001). ***Hint:*** **AHI 1:** AHI values calculated with the PAT method; **AHI 2:** AHI values calculated with the PSG.

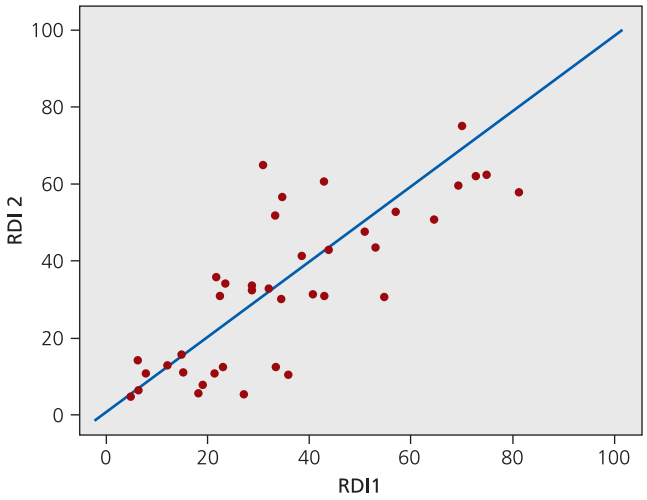

Fig. 2. Scatter plot of RDI 1 versus RDI 2. There was a high correlation between RDI 1 versus RDI 2 (r=0.753, p<0.001). ***Hint:*** **RDI 1:** RDI values calculated with the PAT method; **RDI 2:** RDI values calculated with the PSG.

When the PAT and AHI scores for the patients enrolled in the trial were taken into consideration; 89.7% of the patients were correctly diagnosed with OSAS (AHI≥5) (**Table 4**); for RDI measured by PAT, 100% of OSAS diagnoses (AHI≥5) were correct (**Table 5**); for AHI values calculated using the PAT method, taking 15 as the cut-off point, the sensitivity was found to be at an extremely high level of 96.1% (**Table 4**).

Discussion

Early diagnosis of all patients with OSAS is a public health priority from the point of view of preventing the severe morbidities that develop alongside the illness.[9] Once diagnosed, it is a chronic illness that may require long-term follow-up. Therefore, there is a need for a technique

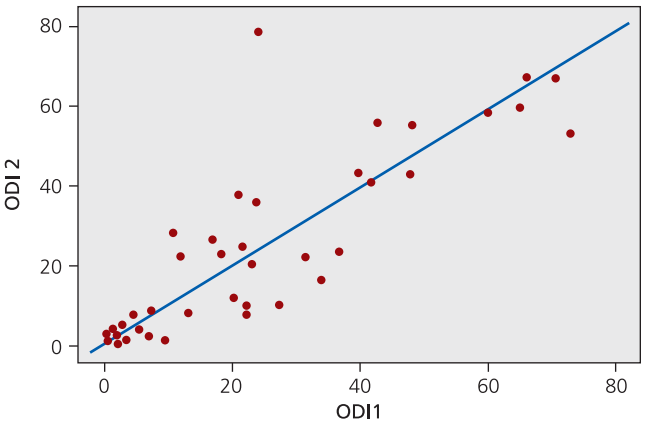

Fig. 3. Scatter plot of ODI 1 versus ODI 2. There was a high correlation between ODI 1 versus ODI 2 (r=0.861, p<0.001). ***Hint:*** **ODI 1:** ODI values calculated with the PAT method; **ODI 2:** ODI values calculated with the PSG.

Table 4. McNemar's test results for AHI measurements (PAT *versus* PSG).

Cut-off	McNemar's p-value	Sensitivity	Specificity	Positive predictive	Negative predictive	Accuracy
AHI≥5	0.250*	89.7%	100%	100%	25%	92.3%
AHI≥15	0.375*	96.1%	69.2%	86.2%	90%	89.1%
AHI≥30	0.023*	70.8%	92.8%	94.4%	65%	83.3%

*Correlation is significant at the level where p equals 0.05 and above. **AHI≥5:** McNemar's test results using a cut off of AHI≥5. **AHI≥15:** McNemar's test results using a cut off of AHI≥15. **AHI≥30:** McNemar's test results using a cut off of AHI≥30.

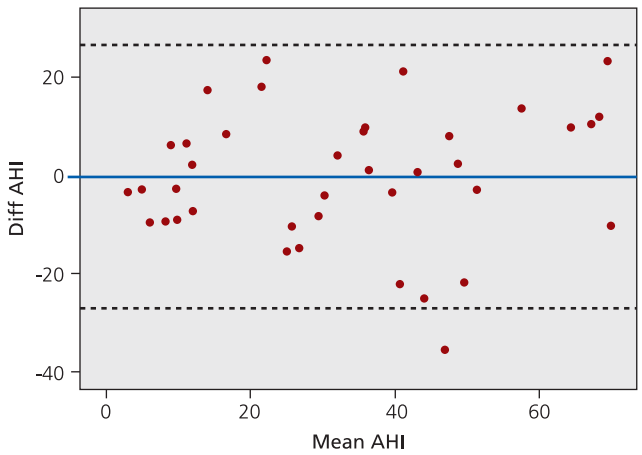

Fig. 4. Bland-Altman plot of PSG AHI vs PAT AHI. *Hint:* **PSG AHI:** AHI values calculated with the PSG; **PAT AHI:** AHI values calculated with the PAT method; Mean AHI=(PAT_AHI+PSG_AHI)/2; Diff AHI= PAT_AHI - PSG_AHI.

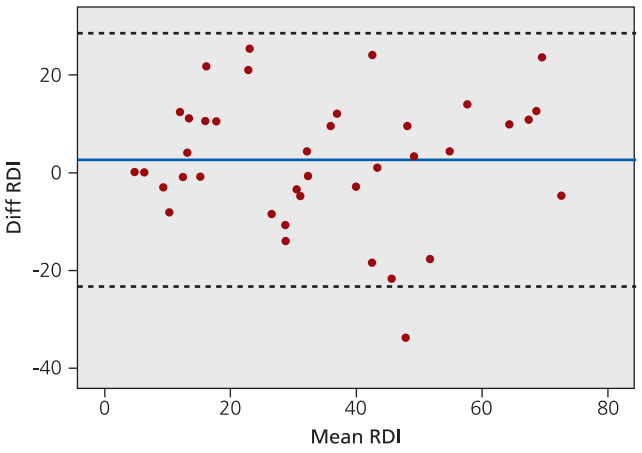

Fig. 5. Bland-Altman plot of PSG RDI versus PAT RDI. *Hint:* **PSG RDI:** AHI values calculated with the PSG; **PAT RDI:** AHI values calculated with the PAT method; Mean RDI=(PAT_RDI+PSG_RDI)/2; Diff RDI=PAT_RDI - PSG_RDI.

that is diagnostic for OSA and can be used for follow-up, which is inexpensive, easily accessible, easy to use, measures accurately and does not cause any side effects.

Schnall et al. identified and published their findings in 1999 that the sympathetic nervous system causes upper airway constriction and arousal from sleep, vasoconstriction peripherally and changes in arterial tone.[10] From 2003 onwards, the first studies involving sleep monitoring that make use of this discovery have begun to appear in the literature.[11] There are research articles confirming the value of WatchPAT for the diagnosis of OSA already available.[7,12] In a meta-analysis conducted using 14 studies comparing PAT and PSG, there was a high correlation (r=0.889, p<.001) in terms of RDI and AHI values. The correlation for the ODI value was also very high (r=0.942; p<0.001).[13] Undiagnosed and untreated OSA is a significant burden on the healthcare system, with increased healthcare utilization seen in those with untreated OSA.[14]

The devices for sleep monitoring can be put into 4 separate categories (types 1, 2, 3 and 4).[15] In Level 1, full polysomnography requires an attendant and goes on over the course of a night. Level II is a complete PSG over the entire night, but minus an attendant. Level III PSG has limitations of generally only recording airflow through the mouth and nose and breathing movements of the chest and abdomen (although it may also encompass lying position and snoring volume), and again does not require an attendant. Level IV is very restricted, confined to airflow through the nose and mouth and oxygenation level.[12] The WatchPAT device detects three principal effects. Roughly, this is the awareness of the patient via the actigraph component, sympathetic activation level via the tonometry apparatus (a type of opticopneumatic sensor), and oxygenation via the digital pulse oximeter. After integrating all these data streams, the device issues a detailed and thorough report listing AHI and RDI as well as RERAs.

The portable monitor implementing a PAT system that was used in our research gave results that correlate

Table 5. McNemar's test results for RDI measurements (PAT *versus* PSG).

Cut-off	McNemar's p-value	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
RDI≥5	1.000*	100%	100%	100%	100%	100%
RDI≥15	0.375*	96.1%	38%	75%	83%	76.9%
AHI≥30	0.227*	79.1%	92.8%	95%	72.2%	84.2%

*Correlation is significant at the level where p equals 0.05 and above. **RDI≥5:** McNemar's test results using a cut off of RDI≥5. **RDI≥15:** McNemar's test results using a cut off of RDI≥15. **RDI≥30:** McNemar's test results using a cut off of RDI≥30.

strongly with those obtained by a type 1 polysomnogram. Despite being obtained at different times, values for AHI, RDI and ODI, calculated by the two different methods, were well correlated and similar to each other.

To diagnose OSA, the plan should encompass taking a history focused on sleep, physical examination and diagnostic investigations. The results here confirm what other studies have claimed regarding the validity and reliability of WatchPAT in diagnosing OSA.[7,12,13,16,17]

Type III sleep monitoring (unattended) is endorsed by AASM as a component of a full OSA diagnostic work-up, provided that initial clinical suspicion is high and the patient does not have other co-occurring illnesses. In the group with comorbidities, PSG should be standard for those with systolic or diastolic cardiac insufficiency, treated as a guideline recommendation for those with coronary artery disease, and as optional for patients with a history of stroke or transient ischaemic attacks.[18]

Diagnosed cases of OSA are only the visible part of a far larger latent epidemic of patients whose breathing problems remain unseen and untreated. 17% of drivers in a European survey report having become drowsy at some point in the previous two years whilst in control of a vehicle, indicates the fact that such drowsiness is frequent .[19] Factors linked with drowsiness whilst driving included inadequate sleep, being young, being male, driving a lot, experiencing drowsiness in general during the day and tending to develop OSA. Having OSA puts you in great hazard of a traffic accident.[20,21]

One warning about applying the results described here is that hypopnea and apnea cannot reliably be differentiated by the WatchPAT apparatus, since it cannot quantify airflow. However, in general, the high level of correlation and correspondence of key respiratory indicators between PSG and WatchPAT, e.g. AHI, RDI and ODI, is a notable finding.

In sleep monitoring using PAT, RDI sensitivity was higher than AHI sensitivity when the cut-off point was set to 5. When the AHI value was found to be 5 or below, especially in the PAT test, RDI value needs to be carefully considered. When the reference values were taken as 15 and 30 in PAT measurements, no significant difference was found between the sensitivities of AHI and RDI. Patients with a score of 15 or more on PAT can have OSA detected 96.1% of the time correctly.

There are some limitations to this study. One of the limitation is a possibility of night-to-night variation because the PSG and sleep monitoring with PAT were not conducted simultaneously on the same night. However, both this study and the study of Pittman et al.[7] showed that there was a good concordance between values calculated with PSG and PAT. The other limitation is the small number of subjects.

In conclusion, this research indicates that, for the screening of potential OSAS cases, and likewise, where a high clinical index of suspicion exists at first diagnosis, as well as for the follow-up of certain particular patient groups, just as the American Academy of Sleep Medicine underlined in their 2017 report,[22] PAT can be used confidently by clinicians.

Conflict of Interest: No conflicts declared.

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Please cite this article as: Özergin Coşkun Z, Dursun E, Şahin Ü, Çelebi Erdivanlı Ö, Terzi S, Çeliker M, Demirci M. An evaluation of peripheral arterial tonometry for the diagnosis of obstructive sleep apnea. ENT Updates 2018;8(1):19–26.